Mathematics 615 3 cr. Applied Differential Equations I

Prerequisite:

Mathematics 255 and Math 568 or permission of instructor.

Catalog Description:

Modeling by differential equations and biological processes. Topics include explicit solutions, existence and uniqueness, *n*-dimensional linear ODE systems, geometric theory, bifurcation analysis.

Purpose of Course:

To provide the student with an understanding of how differential equations are derived as mathematical models as well as how these systems may be analyzed and interpreted within the context of applications.

Text:

Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry and Engineering, Steven Strogatz. Westview Press, 2001.

Topics and Sample Syllabus

y' = f(x,y) explicit solution	(1 week)
Existence and uniqueness	(1 week)
Linear ODE systems, 2x2	(1 week)
Linear systems, general	(1 week)
Geometric theory	(1 week)
Bifurcation analysis	(2 weeks)
Computing bifurcation diagrams	(1 week)
Hopf bifurcation	(2 week)

Grading:
One midterm (100 pts), homework (200 pts: 8 problem sets), and final exam (200 pts)

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct (http://studentaffairs.osu.edu/info_for_students/csc.asp).

Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated, and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; http://www.ods.ohio-state.edu/."

Mathematics 616 3 cr. Applied Differential Equations II

Prerequisite:

Mathematics 615 or permission of instructor.

Catalog Description:

Introduction to the basic types of partial differential equations and their solutions with applications to physical and biological processes; methods of separation of variables and Fourier transform.

Purpose of Course:

An applied introduction to PDE's, focusing on the Laplace equation, heat equation, and wave equation. The primary methods studied will be separation of variables and Fourier transform.

Text:

Partial Differential Equations: Analytical and Numerical Methods, Mark S. Gockenbach. SIAM, 2002.

Topics and Sample Syllabus

Solving PDEs by separation of variables:

(i) Laplace equation (3 weeks)

(ii) Heat equations (3 weeks)

(iii) Wave equations (2 weeks)

Fourier transform method (2 weeks)

Grading:
One midterm (100 pts), homework (200 pts), and final exam (200 pts)

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Mathematics 617 3 cr. Applied Differential Equations III

Prerequisite:

Mathematics 616 or permission of instructor.

Catalog Description:

Topics in applied ODEs and PDEs. Possible topics include solution of the Dirichlet problem in general domains, integral equations, nonlinear PDEs, chaotic dynamics, singular perturbations.

Purpose of Course:

Gain deeper understanding of some of the important methods used in applying differential equations to real world problems.

Text:

Partial Differential Equations, Lawrence C. Evans, American Math. Soc. Press, 1998.

Topics and Sample Syllabus

The Dirichlet problem	(2 weeks)
Integral equations method	(2 weeks)
Nonlinear evolution equations	(2 weeks)
Wave equations by method of characteristic curve	(1 week)
Chaotic dynamics of ODE and difference equations	(1 week)
Singular perturbations	(2 weeks)

Grading:
Homework (300 points) and final exam (200 points)

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